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Does the GeoGebra Application Affect Students' Motivation in Learning Mathematics?

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Abstract

This study aims to improve students' learning motivation through the use of the GeoGebra learning application in overcoming challenges related to student interest in mathematics learning, particularly at SDN 074 Ayudia, Bandung City, with a population of all students and a sample of 31 students from class VA. This study uses a quantitative research method with an explanatory research approach. The sampling technique used is probability sampling with simple random sampling, while the instruments used are questionnaires and tests. The data analysis requirements testing includes normality testing using Kolmogorov-Smirnov and linearity testing, with the hypothesis tested through correlation and regression analysis using SPSS version 26. Based on the research results, it can be concluded that the GeoGebra application has a significant effect on students' mathematics learning motivation. The correlation analysis shows a very strong relationship between the two variables, with a correlation coefficient of 0.826, indicating that the use of the GeoGebra application can increase students' motivation in learning mathematics. This study also found that the GeoGebra application contributes 68.3% to the variation in students' learning motivation, showing that this technology has a significant impact on motivating students. This study implies that the GeoGebra application can be an effective learning tool to enhance students' motivation in mathematics learning.

Keywords: *GeoGebra Application, Interactive Learning, Mathematics*

INTRODUCTION

In today's era of globalization, the ability to use technology is rapidly advancing, especially as teachers are required to use technology to enhance students' interest in learning through various learning media (Mesra et al., 2023; Nurillahwaty, 2022). Learning media can vary depending on the material being taught. Learning media can be visual, audio, or audiovisual-based (Saleh et al., 2023). Mathematics is a subject that requires a high level of focus and skill in order to be easily understood, as

well as effective teaching methods. Mathematics can become more interesting with the use of interactive media, which allows students to engage in the learning process. One example is using educational applications, making the learning process more meaningful (Fatimah, 2023; Maghfiroh et al., 2024; Wardani & Subekti, 2022).

Mathematics is a subject that plays an important role in education (Farhan & Jumardi, 2023). However, many students still struggle to understand the concepts in mathematics, especially in mastering abstract concepts that require higher-order thinking (Farhan & Jumardi, 2023; Muqtafia et al., 2022; Ningsih et al., 2022; Rizqi et al., 2023). As a result, students' interest in learning mathematics declines. Their enthusiasm for mathematics lessons becomes smaller, and they feel that the material is very difficult to learn (Barimbing et al., 2022; Putri, 2023). Therefore, in this context, technology is essential to support the existing learning process. Technology can be an effective tool in the learning process by using software applications to help understand mathematical learning material, one of which is GeoGebra.

GeoGebra is a free and open-source software application designed to facilitate the learning process of mathematics through a more interactive and visual approach (Al Ayyubi, Rohmatulloh, Suryana, et al., 2024). This application was developed by Markus Hohenwarter in 2001 and has since been widely used worldwide. GeoGebra combines several branches of mathematics such as geometry, algebra, calculus, and more, all available in one easily accessible platform. Additionally, this application offers features that allow users to draw, manipulate, and analyze mathematical objects dynamically. This makes it easier for students to explore and understand mathematical learning material more easily (Fathurrahman & Fitrah, 2023; Jabnabillah & Fahlevi, 2023; Siregar et al., 2023; Vinsensia et al., 2022).

Research on the influence of using the GeoGebra application on students' motivation in learning mathematics is important, especially in identifying the extent to which this application can increase students' enthusiasm in mathematics learning (Al Ayyubi, Rohmatulloh, Saputra, et al., 2024). Some studies have shown that the use of this application can affect students' interest in learning mathematics, although the specific influence has not been discussed in depth. Therefore, this research aims to enhance students' learning motivation through the use of the GeoGebra learning

application. By understanding this influence, it is hoped that a more effective approach can be found to address the challenges of students' learning interest in mathematics education.

METHOD

This study uses a quantitative research method with an explanatory research approach (Sugiyono, 2021). The purpose of this research is to describe the relationship and cause-and-effect influence between the independent and dependent variables, which in this case are the GeoGebra application and students' mathematics learning motivation. Therefore, the study used is a causal-correlational study. A causal-correlational study is a method used to examine the relationship or influence between the independent variable and the dependent variable, referred to as variable X and variable Y, without direct manipulation. This research was conducted at SDN 074 Ayudia, Bandung City, with a population of all students and a sample of 31 students from class VA.

The sampling technique used is probability sampling with simple random sampling, while the instruments used are questionnaires and tests. The data analysis requirements testing consists of normality testing using Kolmogorov-Smirnov and linearity testing, with hypotheses tested through correlation and regression analysis assisted by SPSS version 26. If the data is normally distributed, the data analysis continues with Pearson correlation testing, followed by regression analysis to predict the dependent variable based on the independent variable (Setyawan et al., 2021). However, if the data is not normally distributed, the analysis continues with Spearman correlation testing without regression analysis (Arnani, 2024; Wulansari, 2023).

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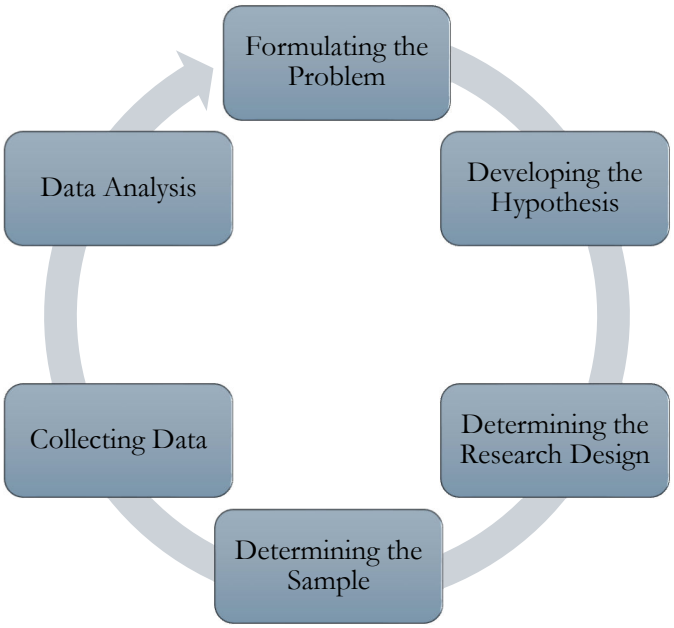

Picture 1. Steps in Research Design

RESULTS AND DISCUSSION

Results

Normality Test is conducted to determine whether the data obtained comes from a population that is normally distributed. This is a prerequisite for inferential statistical testing. In this case, the researcher used the Kolmogorov-Smirnov test to conduct the normality test.

Table 1. Normality Test Output

		Statistic	Sig.
Value	GeoGebra application	.115	.200*
	Mathematics Learning Motivation	.112	.200*

Based on the data in Table 1, the significance value for GeoGebra Application and Students' Mathematics Learning Motivation is 0.200. From this data, the significance value is greater than 0.05, so based on the decision criteria, the null hypothesis (H5) is accepted. Therefore, it can be concluded that the data is normally distributed.

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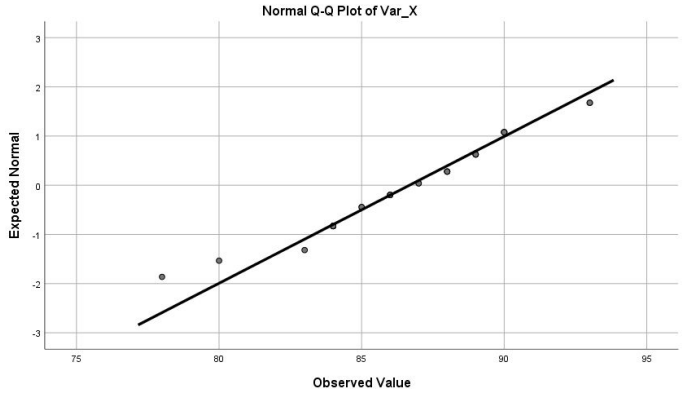
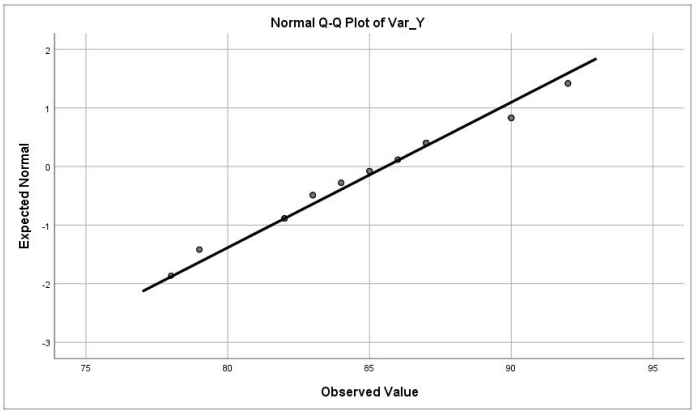


Picture 1. Normal Q-Q Plot Var_X



Picture 2. Normal Q-Q Plot Var_Y

In the Normal Q-Q Plot diagram of GeoGebra Application and Students' Mathematics Learning Motivation, the data points are spread around the diagonal line and are close to it. Thus, it can be concluded that the data is normally distributed. To examine the strength of the relationship, the correlation coefficient is as follows.

Tabel 2. Correlations

		Var_X	Var_Y
GeoGebra Application	Pearson Correlation	1	.826**
	Sig. (2-tailed)		.000
Mathematics Learning Motivation	Pearson Correlation	.826**	1
	Sig. (2-tailed)	.000	

Based on the data in Table 2, the significance value for the GeoGebra Application and Students' Mathematics Learning Motivation is 0.000. From this data, it is obtained that the significance value is less than 0.05, so based on the decision criteria, the null hypothesis (H5) is rejected, and it can be concluded that the GeoGebra Application has an effect on Students' Mathematics Learning Motivation.

Table 3. Correlation Value

Correlation Coefficient Interval	Relationship Strength
0,00 – 0,19	Very low
0,20 – 0,39	Low
0,40 – 0,59	Moderate
0,60 – 0,79	Strong
0,80 – 1,00	Very Strong

Meanwhile, the value of the Correlation Coefficient is 0.826, which falls within the interval of 0.80-1.00. According to the interpretation guidelines in Table 3, it can be said that the relationship between the GeoGebra Application and Students' Mathematics Learning Motivation is very strong. In the Correlations display, it is also evident that the GeoGebra Application and Students' Mathematics Learning Motivation variables are marked with a **, indicating that these two variables are significantly correlated.

Table 4. Model Summary

Model	R Square
1	.683

Based on the data in Table 4, the R Square or Coefficient of Determination value, which shows how well the regression model is formed by the interaction between the GeoGebra Application and Students' Mathematics Learning Motivation, is 0.683 or 68.3%. This means that the GeoGebra Application has an influence of

68.3% on Students' Mathematics Learning Motivation, and the remaining 31.7% is influenced by other factors outside of Students' Mathematics Learning Motivation.

Tabel 5. ANOVA[a]

Model		df	F	Sig.
1	Regression	1	62.397	.000[b]

Based on the data in Table 5, the significance value for the regression is 0.000. From this data, it is obtained that the significance value is less than 0.05, so based on the decision criteria, the null hypothesis (H5) is rejected, and it can be concluded that the linear regression model meets the linearity criteria, so the regression model can be used to predict the independent and dependent variables, namely the GeoGebra Application and Students' Mathematics Learning Motivation.

Tabel 6. Coefficients[a]

Model		Unstandardized Coef.		Sig.
		B	Std. Error	
1	(Constant)	-.590	10.917	
	Aplikasi Geogebra	.994	.126	.000

Based on the data in the Coefficients display, with the constant coefficient and the variable coefficient in the Unstandardized Coefficients B column, the regression equation model is Y = -0.59 + 0.994X. Thus, it can be stated that if the GeoGebra Application value is zero, the Students' Mathematics Learning Motivation will be -0.59. With a regression coefficient of 0.994, it means that if the GeoGebra Application value increases by one unit, the Students' Mathematics Learning Motivation will increase by 1.994. Moreover, from this data, the significance value is less than 0.05, so based on the decision criteria, the null hypothesis (H5) is rejected, and it can be concluded that the GeoGebra Application has a significant effect on Students' Mathematics Learning Motivation..

Discussion

The results of the study show that the use of the GeoGebra application has a significant impact on students' mathematics learning motivation. The normality test, conducted using the Kolmogorov-Smirnov method, produced a significance value of 0.200 for the GeoGebra Application and Students' Mathematics Learning Motivation variables, which is greater than 0.05. This indicates that the data follows a normal distribution, meeting the requirements for inferential statistical analysis. The validity of the data is further supported by the Normal Q-Q Plot diagram, which shows that the data points are spread around the diagonal line, signifying that the normality assumption has been met.

The analysis of the relationship between the GeoGebra Application and Students' Mathematics Learning Motivation indicates a highly significant result. The significance value of the correlation test is 0.000, which is smaller than 0.05, indicating a significant relationship between the two variables. With a correlation coefficient value of 0.826, the relationship is categorized as very strong based on interpretation guidelines. This finding suggests that the more effectively the GeoGebra application is used in mathematics learning, the higher the students' learning motivation. Additionally, the ** symbol in the correlation analysis results emphasizes that the two variables are significantly correlated.

Furthermore, the regression analysis results show that the GeoGebra Application contributes 68.3% to students' mathematics learning motivation, based on an R Square value of 0.683. This means that approximately two-thirds of the variation in students' learning motivation can be explained by the use of the GeoGebra application, while the remaining 31.7% is influenced by other factors not examined in this study. The obtained regression equation model is $Y = -0.59 + 0.994X$, which indicates that for each one-unit increase in the use of the GeoGebra application, students' learning motivation will increase by 0.994. The significance of the regression model, with a value of 0.000, indicates that the model is valid and satisfies the linearity criteria, and can therefore be used to predict the relationship between the GeoGebra application and students' mathematics learning motivation.

Suhendi states, Educational technology, such as the use of the GeoGebra application, can enhance students' learning motivation by introducing mathematical

concepts through more engaging and interactive visualizations, which allow students to be more actively involved in the learning process (Nurhikmah, Indo Santalia, 2023). This statement aligns with the findings of this study, which shows that the use of the GeoGebra application has a significant impact on students' mathematics learning motivation. Furthermore, according to Tarmizi and Usman, "the use of technology-based learning, such as interactive applications, can improve students' conceptual understanding by presenting the material in a more dynamic way and reducing boredom during the learning process (Nursalam., Nurhikmah., & Purnamasari, N, 2019)." This supports the findings of this study, which show that the GeoGebra application not only increases students' motivation to learn mathematics but also positively impacts their understanding of the mathematical concepts being taught. Technology like GeoGebra allows students to learn in a more visual and exploratory manner, which, in turn, strengthens their engagement and interest in the subject of mathematics (Al Ayyubi et al., 2018; Al Ayyubi, Bukhori, Komara, et al., 2024; Al Ayyubi, Hayati, Azizah, et al., 2024; Al Ayyubi, Rohaendi, Herdiansyah, et al., 2024).

Thus, the results of this study imply that the GeoGebra application can be a highly effective learning tool to enhance students' motivation in mathematics. These findings support the importance of integrating technology into the learning process to create a more engaging and interactive learning experience (Birgin & Acar, 2022; Birgin & Topuz, 2021; Birgin & Uzun Yazıcı, 2021; Meisya & Arnawa, 2021; Saputra, 2022). However, there are still other factors influencing students' motivation, such as the learning environment, the role of the teacher, and parental support, which require further study. The integration of the GeoGebra application with other learning approaches could be a strategic step in optimizing students' motivation and academic outcomes in mathematics.

CONCLUSION

Based on the results of the study, it can be concluded that the GeoGebra application has a significant influence on students' mathematics learning motivation. The correlation analysis indicates a very strong relationship between the two variables, with a correlation coefficient of 0.826, suggesting that the use of the GeoGebra

application can enhance students' motivation to learn mathematics. This study also found that the GeoGebra application contributes 68.3% to the variation in students' learning motivation, indicating that this technology has a significant impact on motivating students.

The regression model generated in this study, Y = -0.59 + 0.994X, shows that for each unit increase in the use of the GeoGebra application, students' motivation to learn mathematics will increase by 0.994. This result suggests that the GeoGebra application is not just a visualization tool, but also a key factor in boosting students' motivation to engage more actively and creatively in learning mathematics. This is consistent with the theory that educational technology can stimulate students' interest and involvement in the learning process.

Although the GeoGebra application makes a significant contribution to students' motivation to learn mathematics, this study also acknowledges that other factors, such as the learning environment and the role of the teacher, also influence students' motivation. Therefore, the GeoGebra application should be seen as part of a broader learning approach that includes other educational aspects. These findings provide a strong foundation for educators to more fully integrate technology into the mathematics learning process to create a more engaging learning experience and boost students' motivation.

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